

What is claimed is:

1. A lithium secondary battery, comprising:

a cylindrical battery case provided with electrode caps at both end portions;

an electrode body contained in the battery case and including a positive electrode, a negative electrode, and a separator, the positive electrode and the negative electrode being wound or laminated through the separator; and

an elastic body disposed between said battery case and said electrode caps with portions where said battery case contacts said elastic body being brought into press-contact to form a caulked portion to seal said battery case,

wherein, with  $R_{\text{body}}$  (mm) being diameter of a body part of said battery case,  $R_{\text{top}}$  (mm) being diameter of said caulked portion,  $R_{\text{body}}$  and  $R_{\text{top}}$  fulfill relationship of  $R_{\text{body}} > R_{\text{top}}$ .

2. The lithium secondary battery according to claim 1, wherein said battery case is made of Al or Al alloy.

3. The lithium secondary battery according to claim 1 or 2, wherein, with a difference between said  $R_{\text{body}}$  (mm) and said  $R_{\text{top}}$  (mm) being  $\Delta R$  (mm),  $\Delta R$  fulfills relationship of  $\Delta R \leq 5$  (mm).

4. The lithium secondary battery according to any one of claims 1 to 3, wherein said  $R_{\text{body}}$  and said  $\Delta R$  fulfill a relationship of  $(\Delta R/R_{\text{body}}) \times 100 \leq 10(\%)$ .

5. The lithium secondary battery according to any one of claims 1 to 4,

wherein, with said caulked portion, a deformation quantity in a press-contacting direction of said press-contacted elastic body is larger than a spring-back quantity and a press-contact force applied to said elastic body is not more than a press-contact force with elasticity maintaining rate of said elastic body being not less than 95%.

6. The lithium secondary battery according to any one of claims 1 to 5, wherein said elastic body is made of any of ethylene propylene rubber, polyethylene, polypropylene and fluororesin.

7. The lithium secondary battery according to any one of claims 1 to 6, wherein said electrode cap comprises an electrolyte solution injection port.

8. A lithium secondary battery, comprising:  
a cylindrical battery case provided with electrode caps at both end portions thereof; and

an electrode body impregnated with a nonaqueous electrode solution and contained in the battery case and including a positive electrode, a negative electrode, and a separator, the positive electrode and the negative electrode plate being wound or laminated through the separator;

wherein, tip portions of said battery case and outer periphery portions of said electrode caps are brought into joining with squeezing processing, caulking, and welding.

9. A lithium secondary battery, comprising:

a cylindrical battery case provided at both end portions thereof with electrode caps having battery caps, internal terminals and external terminals; and

an electrode body impregnated with a nonaqueous electrolyte solution and contained in the battery case and including a positive electrode, a negative electrode, and a separator, the positive electrode and the negative electrode being wound or laminated through the separator;

portions where said battery case is in contact with said electrode caps being brought into press-contact to form a caulked portions to execute sealing,

wherein, with  $R_{\text{body}}$  (mm) being diameter of a body part of said battery case,  $R_{\text{top}}$  (mm) being diameter of said caulked portion,  $R_{\text{body}}$  and  $R_{\text{top}}$  fulfill relationship of  $R_{\text{body}} > R_{\text{top}}$ ; and

tip portions of said battery case and outer periphery portions of said electrode caps are brought into joining by welding.

10. The lithium secondary battery according to claim 9,  
5 wherein said battery case is made of Al or Al alloy.

11. The lithium secondary battery according to claim 9 or 10, wherein said battery cap and said external terminal are made of Al or Al alloy.

12. The lithium secondary battery according to any one of  
10 claims 9 to 11, wherein, with a difference between said  $R_{\text{body}}$  (mm) and said  $R_{\text{top}}$  (mm) being  $\Delta R$ (mm),  $\Delta R$  preferably fulfills relationship of  $\Delta R \leq 5$ (mm).

13. The lithium secondary battery according to any one of  
15 claims 9 to 12, wherein said  $R_{\text{body}}$  and said  $\Delta R$  fulfill relationship of  $(\Delta R/R_{\text{body}}) \times 100 \leq 10(\%)$ .

14. The lithium secondary battery according to any one of claims 8 to 13, wherein said battery case is shaped as a pipe.

15. The lithium secondary battery according to any one of claims 8 to 14, wherein entire area of said tip portions of  
20 said battery case and said electrode cap are joined by said welding.

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16. The lithium secondary battery according to claim 9, wherein a squeezed portion is formed in the very vicinity of the outer periphery portion of said electrode cap.

17. The lithium secondary battery according to any one of  
5 claims 1 to 16, wherein battery capacity is 2 Ah or more.

18. The lithium secondary battery according to any one of claims 1 to 17 to be mounted on a vehicle.

19. The lithium secondary battery according to claim 18 for starting an engine.

20. The lithium secondary battery according to claim 18 or  
10 19 for an electric vehicle or a hybrid electric vehicle.

21. A manufacturing method of a lithium secondary battery, comprising the steps of:

forming a battery element by joining respective  
15 electricity collection tabs provided in both ends of internal electrode body which is structured by winding positive electrode and negative electrode via a separator around the outer periphery of a winding core and respective internal terminal portions of two electrode caps together;

20 inserting said battery element into a battery case with both ends being left open; joining respective both end

portions of said battery case with respective outer periphery portions of said two electrode caps; and

injecting electrolyte solution from an electrolyte solution injection port provided in at least one electrode cap; and

sealing said electrolyte solution injection port.

22. The manufacturing method of a lithium secondary battery according to claim 21, wherein respective both end portions of said battery case and respective outer periphery portions of said two electrode caps are joined, and at the same time, or therebefore/thereafter said electrode cap of said battery case undergoes squeezing in the very vicinity portion of an outer periphery portion.

23. The manufacturing method of a lithium secondary battery according to claim 21 or 22, wherein a caulking and/or welding method is used as a method for joining said battery case and said electrode cap.

24. The manufacturing method of a lithium secondary battery according to claim 23, wherein, at the time of said caulking operation, an elastic body is arranged between said battery case and said electrode cap.

25. The manufacturing method of a lithium secondary battery according to claim 24, wherein, as said elastic body, any

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